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ABSTRACT

This research dealt with the social constitution of learning in classroom settings, attempting to reveal Bruner's (1990, 1996) folk psychology or folk pedagogy in everyday teaching and learning processes. Specifically, it focused on how the reasons or arguments for completing activities emerge while children are attempting to solve a given mathematical problem in group work. A microethnographic study of such interactions in German elementary classrooms showed that children do not usually reveal their rationale explicitly, with the execution of a calculation and its justification not discernible from each other--in other words, reflexive argumentation. Further, this practice of reflexive argumentation is effectuated in the semblance of telling a story. The culture of reflexive argumentation in these groups is treated narratively. Examination of the academic task structure (ATS) (Erickson, 1982) of group interactions revealed narrative characteristics: (1) Not all concepts necessary for comprehension of the ATS are introduced explicitly; for some participants, the inner logic of the solution or "plot" remains opaque; (2) students need certain specific competencies for executing different steps of the solution; (3) meta-comments are not clearly made; hints at the internal structure of the solution are left for participants to infer on their own; and (4) presentation of the solution process is mainly restricted to the spoken word; alternative demonstrations like physical illustrations are not used. Thus, this form of peer interaction provides the rationality of a solving process in as much as the students are able to infer the argumentation about the "correctness" of the solution from the specific ATS-sequentiality of the accomplished narrative. (Contains 18 references.) (EV)

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Reflexive Arguing in Elementary School Classes: Opportunities for Learning

ED 409 109

1. Introduction

This presentation is based on two research projects[1], whereby one of them was recently finished and the other has just started about half a year ago. Both projects focus on the reconstruction of argumentative elements in classroom interaction, especially in mathematics group work. Theoretically this is examined by applying and developing microsociological approaches, e. g. social interactionism and ethnomethodology, to the specifics of mathematical teaching-learning processes. Methodologically these projects are interpretative, micro-ethnographic studies of everyday classroom processes.

The general interest of both projects is centered on the analysis of the social constitution of learning in classroom settings. Together, teacher and students bring forth a social space of interaction which is supposed to provide content-related learning. The analysis attempts to reveal in words of BRUNER (1990, 1996) the "folk-psychology" or "folk-pedagogy" of everyday teaching-learning processes, that include the interactively constituted social condition of learning (see KRUMMHEUER 1997).

The main issues of this research-approach are concerned with the reconstruction of

- the rationality emerging during the interactional exchange among the classroom participants,
- the ways this rationality is embedded in the interaction, and
- the extent to which the accomplished rationality will be thematized in the conjoint activities of mathematics classroom-participants.

The specific question which will be dealt with in this paper is: **In what ways does the reason for their activities emerge while children are attempting to solve a given mathematical problem in group work?**

The general answer to that question will be briefly sketched: Usually the children do not bring out this rationality expressively: They perform calculational steps in a certain sequence, what - if successful - finally results in a solution of the

[1] Their titles are "Argumentizing in Elementary Mathematics Classes" funded by the federal state Baden-Württemberg from January 1994 until December 1995 and "The Rekonstruction of Formats of Collective Argumentation" funded by the German Science Foundation (DFG) from October 1996 until September 1998.

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given problem. The rationality of this procedure is implicitly embedded in this systematic sequence of solving steps. The usual mathematical differentiation between the "execution of a calculation" and its "explanation" or "justification" does not appear in such processes of group work. The methods of bringing an action to pass concur with those of showing their verisimilitude (credibility).

With regard to GARFINKEL's ethnomethodology (1967) one can see a specific *accounting practice* in this kind of interaction processes.

> ... the activities whereby members produce and manage settings of organized everyday affairs are identical with members' procedures of making those settings 'account-able' (p. 1).

Ethnomethodologists created for this phenomenon the notion of "**reflexivity**". The relationship between the performance of an interaction and the demonstration of its accountability is reflexive (MEHAN & WOOD 1975, KRUMMHEUER 1995, LEHMANN 1988, VOIGT 1995). This gave me reason to call the kind of accounting practice in elementary mathematics group work the "**practice of reflexive argumentation**".

2. The Narrative Feature of Interaction in Mathematics Group work

The thesis, which will be illustrated in the following, is, that **this practice of reflexive argumentation is effectuated in the semblance of telling a story. In other words, the *culture of reflexive argumentation* in these groups is treated *narratively***.

This thesis does not mean that in lessons stories are told all the time or that beyond teaching-aims in literature-classes, children should be educated in producing narratives. It rather emphasizes that frequently the theme in the group work is negotiated in a way that it can be reconstructed as a narrative accomplishment. The concept of "narration" is used here to describe a specific phenomenon of classroom-*conversation* and is not to be understood in the sense of literary science.

According to BRUNER 1990 one can identify four characteristics for narrations:

1. the specific "sequentiality" of the presentation,
2. the "factual 'indifference'" between the true and the fictive,
3. the "unique way of managing departures from the canonical", and
4. the "dramatic quality" (p. 50, see also EHLICH 1980 and KRUMMHEUER 1997).

Here I will refer especially to the first and third characteristic. The proposed narrativity will be seen in the typical, patterned sequentiality of cooperatively solving processes in group work. The specificity of such an event, like the elaborated solution of a given mathematical problem, is presented with relation to the canonical management of similar events. The reason to reformulate teaching-learning-processes in terms of a theory of narrativity, has to do with the recently proclaimed insight that in our culture narratives play a crucial role in establishing learning environments (see BRUNER 1990, 1996).

Classroom processes embrace some peculiarities, which make them somewhat different from the usual perception of narrations:

- Frequently students and teacher complement each other in the role of the story-teller. There are no strictly determined roles of the "story-teller" and the "listener" (see for example KLEIN 1980). Contrarily usually several persons are involved in staging a story.
- In addition, people do not only tell stories about the past, they also accomplish something new by story-telling (see. COLLMAR 1996, p. 179). Thus, in classroom-situations there is not only the *presentation* of a story but also its *constitution* (see GUMBRECHT 1980, p. 407).

In such an event, while two or three children are cooperating in their group work, they are in charge of two different assignments: They have to clarify

- *what* has to be done *in a specific moment*, and
- *who* is supposed to do it *at that specific moment*.

Both cases have to do with the appropriate moment, whereas

- the first point refers to the sequence of solving steps and its related chronological processing, and
- the second point is focused on the structure of interaction with its alternation of actors and speakers.

ERICKSON (1982) calls the first aspect the **academic task structure (ATS)**. It is based on the interpretation of the task situation that is emerging among the interacting participants (see VOLLMER & KRUMMHEUER 1997, KRUMMHEUER 1997). ERICKSON calls the second issue the **social participation structure (SPS)**. Furthermore, both structures are mutually dependent on each other (see ERICKSON 1982, p. 156, and VOLLMER & KRUMMHEUER 1997).

In the following I am going to outline an example exclusively emphasizing major aspects of ATS with regard to its narrative emergence in group work. This is legitimized by my interest in content-related learning processes and by the

fact that the research has explored SPS more sufficiently (see BAUERSFLED et. al. 1985, ERICKSON 1986, MEHAN 1979).

3. An Example

The third-graders Daniel, Slawa and Stanislaw, all boys, are confronted with a problem which has to do with the continuation of a patterned number-sequence. The first four elements are given, and the boys are supposed to find the fifth number. The problem is illustrated in the following way.

What number?

Here you see members of a sports club. The numbers on their shirts create a certain sequence. Which number should be on the shirt to very right?

Relatively quickly Slawa presents an acceptable solution:

47	*Slawa*	(pointing at the picture) *Here you put five, here you put seven´*
49	*Slawa*	*here you put* (.) *nine´*
52	*Slawa*	*He gets an eleven-*
53	*Daniel*	*Why eleven´*
54	*Stanislaw*	*Why´*
55	*Slawa*	*Eleven. look´*, (whispering) *how much plus three, look ´, at this number.*
56		*five-*
57<	*Daniel*	*Yeah´, from three to eight are five.*
58<	*Slawa*	(facing Daniel and still pointing at the picture) *Here you put seven at any rate,*
59		*seven-*
60	*Daniel*	*Seven-*
61	*Slawa*	*Nine´* (.) *eleven.*
62	*Stanislaw*	(indistinctly) *Well.*
63	*Slawa*	*Eleven plus twenty-four. add it to this here. that equals* (figuring for about 2
64		sec) *thirty-five.*

From a mathematical point of view one can see in Slawa's finding the tentative enunciation of two novel concepts:

- the *sequence of differences* as a general concept and
- the *four initial elements of this specific sequence of differences* {5 - 7 - 9 - 11}.

He does not give them a name, let alone define them explicitly. In a certain sense he is also not talking *about* them, but rather *through* them. His two class-

mates can not create any productive idea concerning his utterances. Thus Slawa feels obliged to explain or justify his solution: His reaction is that he lists up the four initial elements of his sequence of differences. At the same time the repetition of this systematic sequence of four numbers functions as an expansion of an argumentation.

Another example of the subsequent interaction among these three boys might deepen this reflexive relation between execution of an action and its rationalization

77<	*Slawa*	*This is five. here* (points at sheet) *you put seven´, here you put nine.*
78<	*Daniel*	*five* (mumbling inarticulate) *eight to fifteen are seven´*
79	*Slawa*	*There are always two more.*
82<	*Slawa*	*Then, here you put eleven´, Daniel* (points at number sequence) *plus eleven*
83<	*Daniel*	*seven´ yes, yes.*
84<	*Slawa*	*to that number. So, there you put*
85<	*Daniel*	*from fifteen to twenty-four there is nine.*
86	*Slawa*	*thirty-five.* (inarticulate) *thirty-five.*
87	*Stanislaw*	*Oh yeah-*
88	*Daniel*	*Yes, nine´*

In this strip of interaction one recognizes, that Daniel can agree upon the results 5, 7, and 9 as the differences between the first elements of the initial sequence in <78, 83 and 85>. But conceptually he and Stanislaw as well do not grasp the enumeration of these numbers as elements of a *number sequence* that is construed by figuring the differences between the elements of the initial number sequence {3 - 8 - 15 - 24}. Even Slawa's "meta-comment" on the rule of construction of this sequence of differences in <79> does not help.

Slawa's finding of the solution, its presentation and his related explanation are narratively displayed. As a listener one has to conceptualize first the concept of a sequence of differences and second its specific definition $x_{n+1} = x_n + 2$ through the repeated enumeration of the numbers 5, 7, 9, and 11. Someone, who can not infer Slawa's argumentation from this enumeration of numbers, does not comprehend the plot of his story, which tells, how one gets a "right result".

Summarizing, one can identify four aspects from this interpretation of the episode:

1. Not all concepts which would be necessary for an insightful comprehension of ATS are introduced explicitly. They are referred to in an opaque

manner. Not all students recognize an ATS in this kind of performance. Thus for them the **plausibility or inner logic** of the "subject matter sequencing" (ERICKSON 1982, p. 154) remains beyond their comprehension.

2. The students need certain **specific competencies** for executing the different steps of a solution, like addition or subtraction in its missing-addend-representation.
3. "**Meta-comments**" have not been clearly made on the functionality of ATS and/or some of its single steps. This will be seen here as a specific trait of narrative interaction. Hints at the internal structure of the solution, at the basic concepts, at relations between different solving steps etc. are not eluminated. The students have to infer that by themselves.
4. The presentation of the solution process is mainly restricted to the spoken word. No **alternative demonstrations** like paintings or other physical illustrations are used. This also is seen as a characteristic of narrative interaction in mathematics group work

Essentially, this shows that on the communicative surface nothing more than the execution of plain calculations happens. This is not an uncommon phenomenon of group work in mathematics classes, even at the secondary level (see KRUMMHEUER 1983). But severe scrutiny reveals:

> These calculations represent only the surface of a more deeply structured ratinonal process, that is typical for narratively shaped processes of interaction.

Thus, this form of peer interaction provides the rationality of a solving process in as much as the students are able to infer the argumentation about the "correctness" of the solution from the specific ATS-sequentiality of the accomplished narrative.

4. The constituted conditions of learning in students' group work

The basic conviction of this theoretical approach is, that the interaction in group work among students and all the other kinds of classroom organization as well exhibit an established and vigorous "folk-psychology" (BRUNER 1990, 1996) of learning in classroom culture, which by no means is God-given. But it is distinguished by two prevalent characteristics: it works and it contains rationality - obviously both aspects make this practice relatively intransigent with respect to short-winded intentions of innovation or to those which are ignorant of the interactional dimension of teaching-learning processes.

The rationality is expressed by the sequenced execution or inventive creation of an ATS. By this a sequence of working-steps is established, which the participants find appropriate in relation to the recognized problem and which let them expect a plausible result while keeping the sequentiality of this ATS. Its interactive realization takes place in a narrative stile: The single steps according to such an ATS are narrated, as long as the necessary competence for the performance of the single steps can be achieved. Typically, in such narratively performed academic task sequences the inner logic of the entire processing will not be expressed explicitly, but needs to be inferred from the sequentially structured narrative by each participant.

Certainly, the following model of participation in a narratively shaped classroom process can not be drawn entirely from the presented episode. Rather, it is one result of the whole research-project about "Argumentizing in Elementary Mathematics Classes" (see above and KRUMMHEUER 1997). The given example might illustrate major aspects of the following research-result:

> The children will be participantly integrated in an ATS-sequenced interaction by processing autonomously those working-steps, which they are able to execute. Eventually through multiple repetition of such sequences each child might perform all steps of the ATS in a sovereign way - which possibly might indicate a learning progress.

Such narratively impinged task-sequences gain argumentative verisimilitude only if the children can identify the co-narrated rational core from the accomplished solving-sequence. If certain students dispose already of such an argumentative common place, then they necessarily do not learn anything new but just produce a reasonable solution. However, if some children are unfamiliar with such an argumentation, then they are challenged, to generate the typical and enclosed persuasive plausibility of the solving process from the ATS–governed sequentiality. By this they are going to create a newly sound perspective on the solution of the problem.

Of course, the last will not happen successfully all the time and will not happen immediately in its entire way. In order to provide such learning processes for the students in the classroom, the chance might be increased by repeated initiations of interaction processes structured similarly to an ATS. But the fundamental learning progress, like creating novel concepts and insights, does not occur coercibly. Possibly only a routinization of the ATS-governed solving process is fortified: Problems of the same type just with slightly altered numbers

will be solved inasmuch as the competence for the performance of the single working steps is available.

This described model of the folk-psychology of classroom-learning is based on the notion of the increasing autonomy of the learner within a classroom-culture of frequently recreated and relatively immutably patterned interaction processes. BRUNER (1983) developed this approach in his study of first language acquisition in early childhood. With regard to the subsequent learning in school-environments the content-related specifics of such encounters need to be taken into account. Here ERICKSON's concept of the "academic task structure" was introduced to adapt BRUNER's approach about language acquisition to teaching-learning processes in regular classroom settings.

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